



Date: 12/18/63

Technical Standard Order

Subject: TSO-C73, STATIC ELECTRICAL POWER INVERTER

Technical Standards Orders for Aircraft Materials, Parts and Appliances

Part 514 which contains minimum performance standards and specifications for materials, parts, and appliances used in aircraft consists of two subparts. Subpart A contains the general requirements applicable to all Technical Standard Orders. Subpart B contains the technical standards and specifications to which a particular product must conform.

ANY TECHNICAL STANDARD ORDER MAY BE OBTAINED BY SENDING A REQUEST TO FAA, WASHINGTON 25, D.C.

Subpart A—GENERAL

§514.0 Definition of terms.

As used in this part:

(a) “Administrator” means the Administrator of the Federal Aviation Agency or any person to whom he has delegated his authority in the matter concerned.

(b) “FAA” means Federal Aviation Agency.

(c) “Manufacturer” means a person who controls the design and quality of an article produced under the TSO system, including all parts thereof and processes and services related thereto obtained from outside sources.

(d) “Article” means the materials, parts, or appliances for which approval is required

under the Civil Air Regulations for use on civil aircraft.

§514.1 Basis and purpose.

(a) *Basis.* Section 601 of the Federal Aviation Act of 1958, and §§3.18, 4a.31, 4b.18, 5.18, 6.18, 7.18, 10.21, 13.18, and 14.18 of this title (Civil Air Regulations).

(b) *Purpose.* (1) This part prescribes in individual Technical Standard Orders the minimum performance and quality control standards for FAA approval of specified articles used on civil aircraft¹, and prescribes the methods by which the manufacturer of

such articles shall show compliance with such standards in order to obtain authorization for the use of the articles on civil aircraft.

(2) The performance standards set forth in the individual Technical Standard Orders are those standards found necessary by the Administrator to assure that the particular article when used on civil aircraft will operate satisfactorily, or accomplish satisfactorily its intended purpose under specified conditions.

¹Articles may also be approved and manufactured for use on civil aircraft as a part of the type design of a type certificate for an aircraft engine or propeller.

§514.2 TSO authorization.

(a) *Privileges.* No person shall identify an article with a TSO marking unless he holds a TSO authorization and the article meets the applicable TSO standards prescribed in this part.

(b) *Letters of acceptance issued prior to July 1, 1962.* An FAA letter of acceptance of a statement of conformance issued for an article prior to July 1, 1962, is an authorization within the meaning of this part and the holder thereof may continue to manufacture such article without obtaining an additional TSO authorization, but shall comply with the requirements of §514.3 through §514.10.

(c) *Application.* The manufacturer or his duly authorized representative shall submit an application for a TSO authorization together with the following documents (See Appendix A of this subpart for sample application) to the Chief, Engineering and Manufacturing Branch, Flight Standards Division, in the region in which the manufacturer is located.²

(1) A statement of conformance certifying that the applicant has complied with the provisions of Subpart A and the article meets the applicable performance standards established in Subpart B of this part (See Appendix B

of this subpart for sample statement of conformance);

(2) Copies of the technical data required in the performance standards set forth in Subpart B of this part for the particular article;

(3) A description of his quality control system in the detail specified in §1.36 of this title (Civil Air Regulations). In complying with this provision the manufacturer may refer to current quality control data filed with the Agency, as a part of a previous application.

NOTE: When a series of minor changes in accordance with §514.5 is anticipated, the manufacturer may set forth in his application the basic model numbered article with open brackets after it to denote that suffix change letters will be added from time-to-time e.g., Model No. 100().

(d) *Issuance.* (1) Upon receipt of the application and adequate supporting documents specified in paragraph © of this section to substantiate the manufacturer's statement of conformance with the requirements of this part and his ability to produce duplicate articles in accordance with the provisions of this part, the applicant will be given an authorization to identify his article with the applicable TSO marking.

(2) If the application is deficient in respect to any requirements, the applicant shall, upon request by the Chief, Engineering and Manufacturing Branch, sub-

mit such additional information as may be necessary to show compliance with such requirements. Upon the failure of the applicant to submit such additional information within 30 days after the date of the request therefor, his application will be denied and he will be so notified by the Chief, Engineering and Manufacturing Branch.

NOTE: The applicant will be issued an authorization or notified of the denial of his application within 30 days after the date of receipt of such application or, in the event that additional information has been requested, within 30 days after the date of receipt of such additional information.

§514.3 Conditions on authorizations.

The manufacturer of an article under an authorization issued under the provisions of this part shall—

(a) Manufacturer such article in accordance with the requirements of Subpart A and the performance standards contained in the applicable TSO of Subpart B of the part;

(b) Conduct the required tests and inspections, and establish and maintain a quality control system adequate to assure that such article, as

²Regional Offices are located at New York, Atlanta, Kansas City, Fort Worth, Los Angeles, Anchorage.

manufactured, meets the requirements of paragraph (a)

of this section and is in a condition for safe operation;

(c) Prepare and maintain for each type or model of such article a current file of complete technical data and records in accordance with §514.6; and

(d) Permanently and legibly mark each such article with the following information:

(1) Name and address of the manufacturer,

(2) Equipment name, type or model designation,

(3) Weight to the nearest tenth of a pound,

(4) Serial number and/or date of manufacturer, and

(5) Applicable Technical Standard Order (TSO) number.

§514.4 Deviations.

Approval for a deviation from the performance standards established in Subpart B may be obtained only if the standard or standards for which deviation is requested are compensated for by factors or design features which provide an equivalent level of safety. A request for such approval together with the pertinent data shall be submitted by the manufacturer to the Chief, Engineering and Manufacturing Branch of the Region in which the applicant is located.

§514.5 Design changes.

(a) *By Manufacturer*—(1) *Minor changes.* The manufacturer of an article under an authorization issued pursuant to the provisions of this part may make minor design changes to the article without further approval by the FAA. In such case the changed article shall retain the original model number and the manufacturer shall forward to the Chief, Engineering and Manufacturing Branch such revised data as may be necessary for compliance with §514.2(c).

(2) *Major changes.* If the changes to the article are so extensive as to require a substantially complete investigation to determine compliance with the performance standards established in Subpart B, the manufacturer shall assign a new type or model designation to the article and submit a new application in accordance with the provisions of §514.2(c).

(b) *By persons other than the manufacturer.* Design changes to an article by a person other than the manufacturer who submitted the statement of conformance for such article are not eligible for approval under this part, unless such person is a manufacturer as defined in §514.0 and applies for authorization under §514.2(c).

NOTE: Persons other than a manufacturer may obtain approval

for design changes to a product manufactured under a TSO pursuant to the provisions of Part 18 or the applicable airworthiness regulations.

§514.6 Retention of data and records.

(a) A manufacturer holding an authorization issued pursuant to the provisions of this part shall, for all articles manufactured under such authorization on and after July 1, 1962, maintain and keep at his factory:

(1) A complete and current technical data file for each type or model of article which shall include the design drawings and specifications. This technical data shall be retained for the duration of his operation under the provisions of this part.

(2) Complete and current inspection records to show that all inspections and tests required to ensure compliance with this part have been properly accomplished and documented. These records shall be retained for at least two years.

(b) The data specified in paragraph (a) (1) of this section shall be identified and copies transferred to the FAA for record purposes in the event the manufacturer terminates his business or no longer operates under the provisions of this part.

§514.7 Inspection and examination of data, articles or manufacturing facilities.

The manufacturer shall, upon request, permit an authorized representative of the FAA to inspect any article manufactured pursuant to this part, and to observe the quality control inspections and tests and examine the manufacturing facilities and technical data files for such article.

§514.8 Service difficulties.

Whenever the investigation of an accident or a service difficulty report shows an unsafe feature or characteristic caused by a defect in design or manufacture of an article, the manufacturer shall upon the request of the Chief, Engineering and Manufacturing Branch, report the results of his investigation and the action, if any, taken or proposed by him to correct the defect in design or manufacture (e.g., service bulletin, design changes, etc.). If the defect requires a design change or other action to correct the unsafe feature or characteristic, the manufacturer shall submit to the Chief, Engineering and Manufacturing Branch, the data necessary for the issuance of an airworthiness directive containing the appropriate corrective action.

§514.9 Noncompliance.

Whenever the Administrator finds that a manufacturer holding an authorization issued pursuant to the provisions of this part has identified an article by a TSO marking and that such article does not meet the applicable performance standards of this part, the Administrator may, upon notice thereof to the manufacturer, withdraw the manufacturer's authorization and, where necessary, prohibit any further certification or operation of a civil aircraft upon which such article is installed until appropriate corrective action is taken.

§514.10 Transferability and duration.

An authorization issued pursuant to the provisions of this part shall not be transferred and is effective until surrendered, or withdrawn, or otherwise terminated by the Administrator.

APPENDIX A SAMPLE APPLICATION FOR TSO AUTHORIZATION

(Date)
(Addressed to: Chief, Engineering and Manufacturing Branch, Federal Aviation Agency, Region.)

Application is hereby made for authorization to use the Technical Standard Order procedures.

Enclosed is a statement of conformance for the article to be produced under TSO-C-----.

The required quality control data¹ are transmitted: (herewith) (under separate cover).

Signed-----

APPENDIX B SAMPLE STATEMENT OF CONFORMANCE

(Date)
(Addressed to: Chief, Engineering and Manufacturing Branch, Flight Standards Division, Federal Aviation Agency.)

The undersigned hereby certifies that the article listed below by model, type or part number has been tested and meets the performance standards of Technical Standard Order C----- In addition all other applicable provisions of Part 514 of the Regulations of the Administrator have been met.

The technical data required by the TSO in the quantity specified are transmitted: (herewith) (under separate cover).

Authorization to use TSO identification on the article is requested.

Signed-----

§514.79 Static electrical power inverter—TSO-C73.

(a) *Applicability.* Minimum performance standards are hereby established for airborne static electrical power inverter equipment which is to be used on United States civil aircraft engaged in air carrier operations. New models of airborne static electrical power inverter equipment manufactured on or after the effective date of this section

¹Reference may be made to data already on file with the FAA.

shall meet the standards specified in Federal Aviation Agency Standard, "Airborne Static Electrical Power Inverter", dated July 25, 1963.¹

(b) *Marking.* In addition to the marking requirements of Section 514.3 (d), each static inverter shall be marked with the following:

(1) Rated terminal voltage, frequency, and the number of phase;

(2) Rated power in volt amperes;

(3) Output load power factor; and

(4) Maximum operating altitude.

(c) *Data requirements.* In addition to the data required by §514.2, the manufacturer shall furnish to the Chief, Engineering and Manufacturing Branch, Flight Standards Division, Federal Aviation Agency, in the region in which the manufacturer is located, the following technical data:

(1) Six copies of the manufacturer's operating instructions and the equipment limitations. Installation procedures with applicable schematic drawings, wiring diagrams, and specifications. Indicate any restrictions or conditions pertinent to installation, and

(2) One copy of the manufacturer's test report.

(d) *Effective date.* December 18, 1963.

¹Copies may be obtained upon request addressed to Publishing and Graphics Division, Inquiry Section, HQ-440, Federal Aviation Agency, Washington, D.C. 20533.

**FEDERAL AVIATION AGENCY
WASHINGTON, D.C.**

**MINIMUM PERFORMANCE STANDARDS FOR
AIRBORNE STATIC ELECTRICAL POWER INVERTERS**

JULY 25, 1963

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MINIMUM PERFORMANCE STANDARDS FOR AIRBORNE STATIC ELECTRICAL POWER INVERTERS

1.0 GENERAL STANDARDS

1.1 Purpose: To specify the minimum requirements for airborne static electrical power inverters.

1.2 Scope: This standard provides the minimum performance criteria under environmental test conditions for static electrical power inverters intended to be used as a source of continuous or emergency alternating current power.

1.3 Types of Inverters: This standard applies to static electrical power inverters with a nominal input of 28 volts d.c. and an output of 115 volts, 400 cycles per second.

1.4 Definitions: The following are definitions of terms used throughout this standard:

a. Static electrical power inverter – An equipment made of solid state electrical components which produces an alternating current from a direct current source.

1.5 Ratings of Components. The equipment shall not incorporate in its design any components of such rating that, when the equipment is operated throughout the range of the specified test, the ratings established by the manufacturer of the component are exceeded.

1.6 Proof of Reliability. The design of the equipment shall be such that the application of the specified test produces no condition which would be detrimental to the reliability of equipment manufactured in accordance with such design.

2.0 REQUIRED PERFORMANCE UNDER ENVIRONMENTAL TEST CONDITIONS

The environmental test procedures applicable to a determination of the performance of

the airborne static electrical power inverter are set forth in Appendix A of this standard.

2.1 Power Output: With rated input voltage, the power output shall not be less than that specified in the manufacturer's rating. In specifying the equipment rating the manufacturer shall establish the following:

- a. Minimum output load power factor.
- b. Any special temperature control requirements.
- c. Conditions of electrical loading including tolerance limits.

The inverter shall be capable of delivering at least 10 percent more output than the specified rating for a period of two hour without damage. The inverter under the conditions of paragraph 2.2b. shall deliver 90 percent of the rated load for a period of 5 minutes.

2.2 Voltage Input: The rated input voltage, as measured at the inverter input terminals, shall be 28 volts d.c. The inverter shall:

- a. Be capable of continuous operation under full load without degradation of performance over an input voltage range of ± 2 volts.
- b. Operate electrically at an input voltage of 20 volts.
- c. Withstand, without damage, input voltage transients of 88 volts for a time period of 1 millisecond.

NOTE: For complex electrical systems, the specified transient overvoltage can rise to much higher values over the time period of 1 millisecond or longer. For such application conservative values of transient overvoltage are recommended.

2.3 Frequency: The frequency of the inverter under all conditions of load and test environment shall be 400 cycles per second ± 1 percent at the input voltages specified in 2.2 a. and 2.2b.

2.4 Voltage Output: The average phase output voltage, under the conditions of input specified in 2.2a. and 2.2b. and under all conditions of test environment, shall be 115 volts a.c. +5 percent –7 percent.

2.5 Waveform: The output waveform shall be substantially sinusoidal and contain less than 7 percent harmonic distortion under all load conditions not exceeding 110 percent rated output.

2.6 Phase Balance: Output phase voltages, for three phase units, shall not be unbalanced by more than ± 5 percent when applied to balanced loads within a power factor range of 0.80. Displacement between phases shall be within the limits of $120^\circ \pm 5^\circ$.

2.7 Overload Capacity: The inverter shall be capable of withstanding, without damage, a current overload of at least 150 percent for a time duration of 5 minutes.

2.8 Input Overvoltage: The inverter shall be capable of withstanding, without damage, input overvoltage up to 130 percent of the rated input voltage for a time period of 5 minutes while supplying full rated output power.

2.9 Short Circuit Condition: The inverter shall be capable of withstanding, without damage, and output short circuit applied separately to each phase or simultaneously to all phases for a time period of one minute. Within 5 minutes after removal of the short circuit condition, the unit shall be energized and run continuously for a period of at least 20 hours. During this period the unit shall, without degradation of performance, deliver the specified output.

2.10 Dielectric Strength: The equipment shall withstand, without damage, the application of 1,500 volts r.m.s. 60 cycles between windings and between each winding and frame for a time period of 1 minute.

NOTE: If this method of testing is not feasible, dielectric tests may be conducted on components prior to final assembly of with the critical components disconnected.

2.11 Altitude: The inverter shall provide continuous rated power, voltage, and frequency at the maximum declared operating altitude for a period of 24 hours. Inverters Intended for locations in pressurized cabin areas also shall provide rated performance at an altitude of 40,000 ft. for a time period of two minutes without damage.

a. For inverters intended to be installed in pressurized areas, the minimum acceptable declared operating altitude is 10,000 feet.

b. For inverters intended to be installed in unpressurized areas, the minimum acceptable declared operating altitude is 30,000 feet.

2.12 Emission of Spurious Radio Frequency Energy: The levels of conducted and radiated spurious radio frequency energy emitted by the inverter shall not exceed those levels specified in Appendix A of RTCA Paper 120-61/DO-108—Environmental Test Procedures—Airborne Electronic Equipment dated July 13, 1961, for Category A equipment.¹

¹ Copies of this paper may be obtained from the RTCA Secretariat, Room 1072, T-5 Building, 16th and Constitution Avenue, NW, Washington, D.C., at a cost of 75 cents per copy.

APPENDIX A

ENVIRONMENTAL TEST PROCEDURES: ELECTRICAL EQUIPMENT ELECTRICAL POWER INVERTERS

A. TEST EQUIPMENT STANDARDS

1. *Test Facilities:* The apparatus used in conducting the tests described in this Appendix should be capable of producing the specified environmental conditions. The equipment under test should not occupy more than 50 percent of the volume of the test chamber. Heat sources should be disposed so that radiant heat does not fall directly on the equipment under test.

2. *Measurement Tolerances:* Allowable tolerances on test condition measurements are as follows:

- a. Temperature: Plus or minus 4° F.
- b. Altitude: Plus or minus 5 percent.
- c. Humidity: Plus or minus 5 percent relative.
- d. Vibration Amplitude: Plus or minus 5 percent.
- e. Vibration Frequency: Plus or minus 2 percent.

3. *Temperature Stabilization:* Temperature stabilization may be checked by a temperature sensing device in good thermal contact with the largest centrally located internal mass in the equipment under test.

4. *Deterioration:* Deterioration or corrosion of any internal or external components which could in any manner prevent the continued safe operation of the equipment during its service life will constitute failure to meet the environmental test to which the equipment was subjected.

B. TEST PROCEDURES

1. *High Temperature Test:* The equipment shall be placed within the test chamber and the internal temperature of the chamber raised to 160° F. with an internal relative humidity of not more than 5 percent. The item of

equipment shall be maintained at 160° F. for a period of 50 hours. While still at this temperature, the equipment shall be operated to determine compliance with the requirements of paragraphs 2.1 through 2.10. The temperature shall then be reduced to prevailing room conditions and a visual examination conducted in accordance with paragraph A.4.

2. *Low Temperature Tests:*

a. *Method I*—The item of equipment shall be placed within the test chamber and the chamber cooled to and maintained at a temperature of -65° F. until temperature stabilization (See paragraph A.3) of the equipment is reached. While at this temperature, the equipment shall be operated to determine compliance with the requirements of paragraphs 2.1 through 2.10.

b. *Method II (alternate to Method I)*—The equipment shall be placed within the test chamber and the chamber cooled to and maintained at a temperature of -80° F. for a period of 48 hours, at which time the equipment shall be examined in accordance with paragraph A.4. The temperature of the chamber shall then be raised to -65° F. and maintained for an additional 24-hour period, or until temperature stabilization is reached (See paragraph A.3.), whichever is the longer. At the conclusion of this exposure period, while at this temperature, the equipment shall be operated to determine compliance with the requirements of paragraphs 2.1 through 2.10 and visually examined in accordance with paragraph A.4.

3. *Temperature Shock Tests—*

a. *Method I*—The equipment shall be placed within a test chamber wherein a temperature of 185° F. is maintained. The equipment shall be subjected to this temperature for a period of 4 hours, at the conclusion of which, and within 5 minutes, the equipment shall be transferred to a chamber having an internal temperature of -40° F. The equipment shall be subjected to this temperature for a period of 4 hours. This completes one cycle. The equipment may be restored to room temperature before starting the next cycle. The number of complete cycles shall be three. At the conclusion of the third cycle, the equipment shall be removed from the test chamber and within a period of one hour shall be operated to determine compliance with the requirements of paragraphs 2.1 through 2.10. A visual examination shall then be completed in accordance with paragraph A.4.

b. *Method II (alternate to Method I)*—The equipment shall be placed within the test chamber and maintained for a period of at least one hour or until the equipment performance stabilizes at a temperature of $77^{\circ}\pm 27^{\circ}$ F. The chamber temperature shall then be reduced to -67° F. and maintained at this condition for at least one hour or until the equipment performance stabilizes. The internal temperature of the chamber shall then be increased to 160° F. and maintained at this condition for at least one hour or until the equipment performance stabilizes. The internal temperature shall then be returned to $77^{\circ}\pm 27^{\circ}$ F. The equipment shall then be operated to determine compliance with the requirements of paragraphs 2.1 through 2.10.

4. *Humidity Tests—*

a. *Method I*—The equipment shall be placed in the test chamber and set up to simulate installed conditions. The chamber temperature shall be between 68° F. and 100° F. with uncontrolled humidity. During the first 2-hour period the temperature shall be gradu-

ally raised to 160° F. The 160° F. temperature shall be maintained during the next 6-hour period. During the following 16-hour period, the temperature in the chamber shall be gradually reduced to between 68° F. and 100° F., which constitutes one cycle. The relative humidity throughout the cycle shall be not less than 95 percent. The cycle shall be repeated a sufficient number of times to extend the total time of the test to 240 hours (10 cycles). At the conclusion of the 240-hour period, the equipment shall be operated to determine compliance with the requirements of paragraphs 2.1 through 2.10 and a visual examination made in accordance with paragraph A.4. Distilled or demineralized water having a pH value of between 6.5 and 7.5 at 77° F. shall be used to obtain the desired humidity. The velocity of the air throughout the test area shall not exceed 150 feet per minute.

b. *Method II (alternate to Method I)*—The equipment shall be placed in the test chamber and set up to simulate installed conditions. The temperature in the chamber shall be 120° F. and the relative humidity not less than 95 percent. The test conditions shall be maintained for 360 hours. At the conclusion of this period, the equipment shall be operated to determine compliance with the requirements of paragraphs 2.1 through 2.10. An examination in accordance with paragraph A.4 shall then be made.

5. *Altitude Test:* The equipment shall be placed within the test chamber and the internal pressure reduced to the manufacturer's declared operating altitude. The ambient temperature in the chamber (irrespective of the test altitude) shall be -65° F. The equipment shall be maintained at this condition until the temperature stabilizes (See paragraph A.3). While at this condition, the equipment shall be operated to determine compliance with the requirements of paragraphs 2.1 through 2.10.

6. *Vibration Tests:*

a. *Method I*—(Applies to equipment which mounts directly on the structure of aircraft powered by reciprocating, turbo-jet or turbo-propeller engines and to equipment which mounts directly on gas turbine engines)—The test specimen shall be mounted on the apparatus in a manner which is dynamically similar to the most severe condition likely to be encountered in service. The test specimen shall be performing its function during the entire test period whenever practicable. At the end of the test period, the test specimen shall be inspected thoroughly for damage or defects resulting from the vibration test. The amplitude or acceleration for the frequency cycling test shall be within ± 10 percent of the specified values. Vibration tests shall be conducted under both resonant and cycling conditions according to the following vibrations test schedule (Table I):

TABLE I—VIBRATION TEST SCHEDULE

Types	Vibration at		
	Room Temp. (Minutes)	160° F. (Minutes)	−65° F. (Minutes)
Resonance	60	15	15
Cycling	60	15	15

(i) *Resonance*—Resonant frequencies of the test specimen shall be determined by varying the frequency of applied vibration slowly through the specified range of frequencies at vibratory accelerations not exceeding those shown in Figure I. Individual resonant frequency surveys shall be conducted with vibration applied along each of any set of three mutually perpendicular axes of the test specimen. Whenever practicable, functioning of the test specimen should be checked against the requirements of paragraphs 2.1 through 2.10 concurrently with the operation of scanning the frequency range for resonant frequencies. The test specimen shall be vibrated at the indicated resonant conditions for the periods shown in the vibrations test schedule (Table I) and with the applied double amplitude or vibratory acceleration specified in Figure I.

These periods of vibration shall be accomplished with vibration applied along each of three mutually perpendicular axes of vibration. When more than one resonant frequency is encountered with vibration applied along any one axis, the test period may be accomplished at the most severe resonance or the period may be divided among the resonant frequencies, whichever is considered most likely to produce failure. However, in no instance shall the specimen be vibrated on any resonant mode resonance in the vibration test schedule. When resonant frequencies are not apparent within the specified frequency range, the specimen shall be vibrated of periods twice as long as those shown for resonance in the vibration test schedule (Table I) at a frequency of 55 c.p.s. and an applied double amplitude of 0.060 inch.

(ii) *Cycling*—For test specimens mounted on vibration isolators, a vibration test shall be conducted with a constant applied double amplitude of 0.060 inch and the frequency cycling between 10 and 55 c.p.s. in one-minute cycles. Vibration shall be applied along each of three mutually perpendicular axes according to the vibration test schedule (Table I). For specimens which are to be installed in aircraft without vibration isolators, a vibration test shall be conducted with the frequency cycling between 10 and 500 c.p.s. in 15-minute cycles at an applied double amplitude of 0.036 inch or an applied acceleration of ± 10 g, whichever is the limiting value. Vibration shall be applied along each of three mutually perpendicular axes according to the vibration test schedule (Table I).

b. *Method II*—(Apply to equipment which mounts directly to reciprocating engines)—The test specimen shall be mounted on the apparatus in a position dynamically similar to the most severe mounting likely to be used in service. Resonant frequencies of the test specimen shall be determined by varying the frequency of applied vibration slowly through the specified frequency range at vibratory ac-

celerations not exceeding those shown in Figure I. Individual resonant frequency surveys shall be conducted with vibration applied along each of any set of three perpendicular axes of the test specimen. Whenever practicable, the functioning of the test specimen should be checked against the requirements of paragraphs 2.1 through 2.10 concurrently with the operation of scanning the frequency range for resonant frequencies. If resonant frequencies are encountered, the test specimen shall be vibrated successively along each of three mutually perpendicular axes for four hours at the resonant conditions with the applied double amplitude or vibratory acceleration shown in Figure I. When more than one resonant frequency is encountered with vibration applied along any one axis, the test period may be carried out at the most severe resonance, or the period may be divided uniformly among the resonant frequencies, whichever procedure is considered most likely to produce failure. When clearly defined resonant frequencies are not encountered with the specified frequency range, the test specimen shall be vibrated for 12 hours along each of its mutually perpendicular axes at an applied double amplitude of

0.018 inch and a frequency of 150 cycles per second. The test specimen shall be performing its functions during the entire test period whenever practicable. At the end of the test period the test specimen shall be inspected thoroughly for damage or defects resulting from the vibration tests.

7. *Shock Test:* The equipment shall be subjected to the shock conditions as normally used in service, including any shock mount assembly. A shock Testing Machine conforming to Military Specification MIL-S-4456 is suitable for this test.

The test specimen should be subjected to 18 impact shocks of 10 g, each shock impulse having a time duration of 11 ± 1 milliseconds. The intensity should be within ± 10 percent when measured with a filter having a bandwidth of 5 to 100 cycles per second. The maximum g should be reached in approximately $5\frac{1}{2}$ milliseconds. The shock should be applied in the following directions:

- a. Vertically, 3 shocks in each direction.
- b. Parallel to the major horizontal axis, 3 shocks in each direction.
- c. Parallel to the minor horizontal axis, 3 shocks in each direction.

The test specimen should not suffer damage.

The equipment shall be operated to determine compliance with the requirements of paragraphs 2.1 through 2.10.

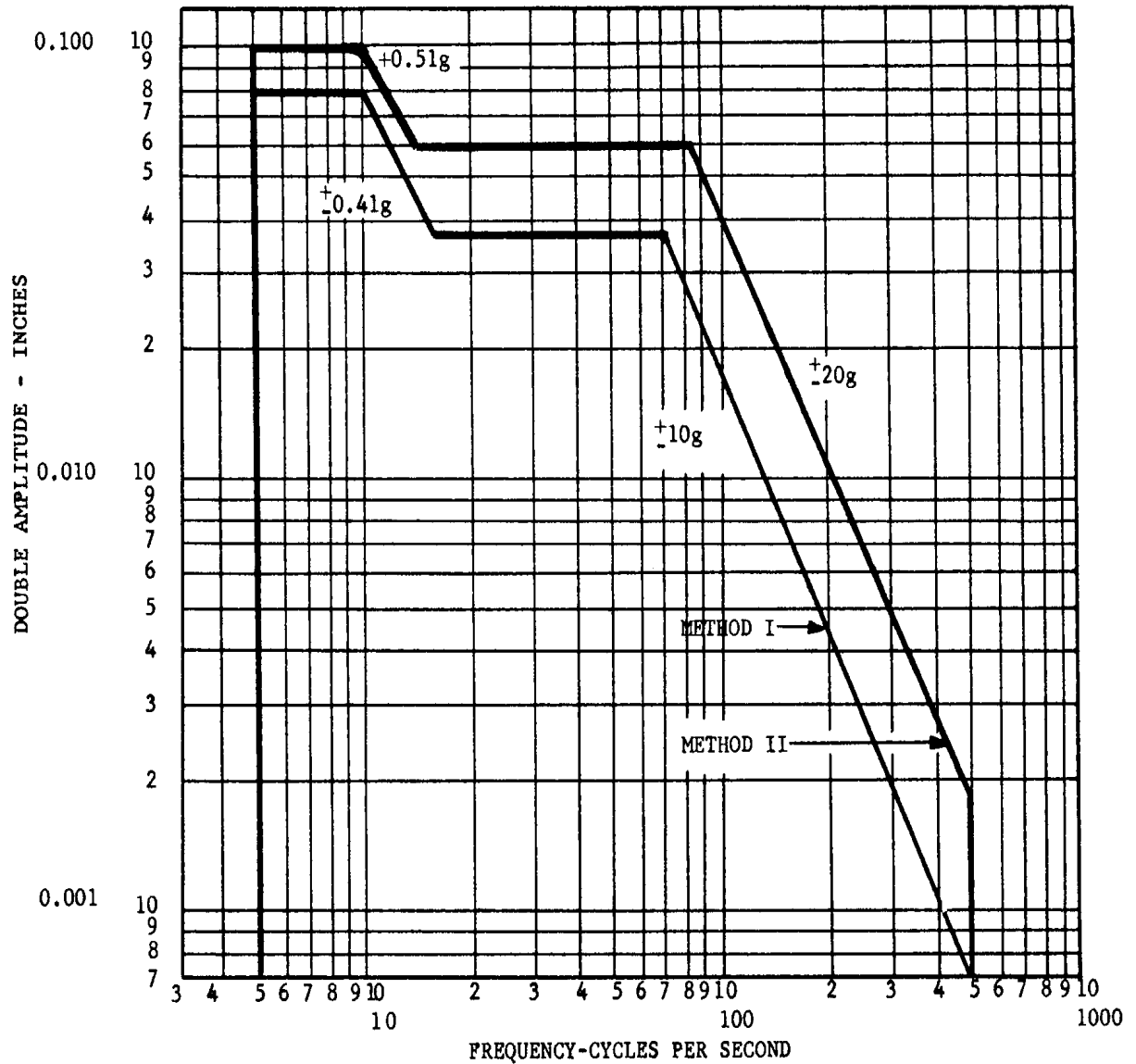


Figure I - Range Curves for Vibration Tests